Kindest regards.
J. M. Johnston.

IMPERIAL MYCOLOGICAL
18 JULY 1940
INSTITUTE

BERMUDA

DEPARTMENT OF AGRICULTURE

REPORT

of the

Plant Pathologist

for the year

1939

Digitized by the Internet Archive
in 2025

https://archive.org/details/report-agriculture-bermuda_1939

Report of the Plant Pathologist, 1939.

The Director of Agriculture,

I have the honour to submit a report of my observations and research work on plant diseases and pests during the year 1939.

GENERAL REVIEW

The extreme weather conditions experienced during the year exerted a profound influence on the nature and intensity of several important diseases and pests, some of which reached serious proportions. Most vegetable crops suffered as a result of the drought conditions during the first half of the year, whilst high winds, culminating in the hurricane of 16th October, did considerable damage to string beans, early planted Bliss Triumph potatoes, carrots, bananas, papaws and cedar trees. There is an old Bermuda belief that hurricanes have a beneficial effect in reducing the incidence of insect pests. Some evidence in support of this theory was obtained from observations made during the autumn months. Caterpillars or "fire-worms" found on potatoes and beets prior to the hurricane disappeared after its advent, and although those on potatoes re-appeared later, beets remained unusually free from insect pests up to the end of the year.

One effect of the dry spring was the presence of spray residue on celery plants at the time of harvesting. As a result, 361 2-bushel crates were condemned on this account on arrival at New York in April.

The dry weather encouraged insect pests like the potato tuber moth, *Phthorimaea operculella* Zell., rather more than fungus diseases, although Common Scab, *Actinomyces scabies* (Thaxter) Güssow on potatoes, and Mildews, *Erysiphe cichoracearum* DC., and *Peronoplasmopara cubensis* (B. & C.) Clinton on cucurbitaceous crops, were prevalent. Fireworms and aphis were abundant as early as March, the latter aiding the spread of several virus diseases. In the lily crop, rosette disease (yellow flat) was more severe than for many years past.

Quarantine measures against the introduction of Japanese beetles, *Popillia japonica* Newm., were successful in intercepting nine live specimens. The Department was fortunate in having the full co-operation of all concerned in the carrying out of the preventative measures formulated.

Much interest was taken by the public in the control of the powder-post termite, *Kalotermes brevis* Walk., in buildings. The significance of the termite menace is best appreciated when repair work is undertaken. The cost of repairs this year to damage caused by these pests in the Mental Hospital was over £400 and in Hamilton Cathedral, which has been attacked in the space of 27 years, over £900. Tests with timber treated with "Rentokil" preservative proved effective in killing termites *in situ*. No evidence of re-infection was obtained over a period of one year. Lumber treated under pressure with coal tar preservative, used in the construction of trestle bridges has shown no signs of attack by dry wood termites *Kalotermes approximatus* Say, over a period of ten years. This species, not only does considerable damage to Bermuda cedar *Juniperus*

bermudiana L., but also to electric light and telephone poles from 12 to 20 years old made from the same tree. Wallaba wood, *Eperua falcata* Aubl. is considerably more resistant, and poles 20 years old show only slight invasion. Cross pieces of green heart, *Nectandra Rodiaei* Hook. have proved very resistant, whilst those of Bermuda cedar and pitch pine, *Pinus palustris* Mill., are very susceptible. Pins for supporting insulators, made from West Indian Locust, *Hymenaea Courbaril* L., are also susceptible to attack and are now being replaced by metal ones.

MAJOR PROBLEMS INVESTIGATED

THE POTATO-TUBER MOTH, *Phthorimaea operculella* Zell.

Serious losses to potatoes stored under ordinary temperatures were caused during the summer months by the potato tuber moth, *Phthorimaea operculella* Zell. Most farmers lost at least one-third of their stores whilst with some the loss amounted to nearly three-quarters. The tuber moth was first mentioned in these Reports in 1932 when it was predicted that it would become one of our most serious pests.

Other plants attacked besides potato are tomatoes, eggplant and sweet peppers. The practice of interplanting potatoes with tomatoes is therefore to be strongly deprecated as it encourages the pest to persist from one crop to the next. Lack of rotation in crops, chiefly potatoes and tomatoes, is responsible for the continuance of this pest as well as the fungous diseases, potato blight and tomato wilt. Other contributing factors are the light porous soil and improper attention to thorough cultivation.

The weather was unusually favourable for the spread of the pest this year. In addition, the dry condition of the soil afforded many crevices whereby the larval or "worm" stage of the moth was able to reach and damage the tubers underground. A great deal of the losses might have been reduced had more care been taken at the time of harvesting in discarding infested tubers, commonly recognised by their greenish colour which indicates that they were incompletely covered by soil during the growing period. Should a Government-sponsored scheme for the supervision of common storage facilities for the farmer's potatoes during the summer months be contemplated, some form of field supervision by an Inspector of Produce at the time of harvesting will be essential, in order to ensure that only sound tubers are harvested and that these are transported direct from the field to the common storage with the minimum of delay. Experiments were conducted to determine whether potatoes dusted with pyrethrum or naphthalene would remain free from tuber moth infection. The storage experiment was at ordinary temperatures and was over 100 days duration. All of the barrels inoculated with a few potatoes infected with tuber moth, on July 1st, were completely rotten or in an unsaleable condition at the end of the experiment. Potatoes stored free from the moth remained uninfected, but there was considerable depreciation on account of water losses. The experiment showed, however, that "clean" potatoes stored in sound barrels could be kept over the summer months in a saleable condition.

An insect-proof cellar store house has been installed by one farmer in Southampton. Potatoes, harvested promptly, were stored successfully there free from moth attack during the summer months. Humidity control was maintained by watering the earthen floor. The provision of further insect proof store houses for the preservation of potatoes during the summer months is an urgent matter requiring immediate attention.

The problem of reducing the amount of tuber moth damage can be solved by the practice of good farming, by the elimination of careless picking at harvesting, and by leaving no tubers exposed for the insect to work upon. The following recommendations are tabulated for fighting the tuber moth by good agricultural practices:—

1. Plant "clean" potato seed as deep as practicable (5 — 6 inches).

2. Use ridge culture, i.e., ridge the rows. Keep the potatoes well moulded throughout the whole period of growth, so that no tubers are exposed for the insect to lay its eggs on. This is especially important during the last three weeks of the growing period or after rain.

3. Spray regularly with lead arsenate every 10 — 14 days in addition to the Bordeaux mixture.

4. Harvest as early as possible after maturity.

5. Harvest before the potato tops become so dry as to drive the partially grown larvae to descend and work on the tuber.

6. Practice crop rotation.

In harvesting the tubers, several rules must be followed to keep the tubers free from infestation:—

1. All green coloured potatoes should be discarded, i.e., those which have been exposed above the surface of the soil to the possible attack by the moth.

2. Barrels should *never* be covered with potato tops, as the larvae leave these when they wilt, and enter the potatoes. Damp sacks will serve as a covering if such is needed.

3. The barrels should be headed as soon as possible and hauled from the field.

4. Potatoes should never be left in the field or exposed to the moth overnight.

5. All cull potatoes should be gathered up within two weeks and either fed to stock at once or destroyed. If left in the field they are a menace to neighbours, and to the grower himself, for the following crop. The practice of gleaning should be encouraged.

Post-harvesting precautions are as follows:—

1. Before each potato harvest, all rooms and stores in which it is intended to store potatoes must be thoroughly repaired and limewashed or fumigated, and made insect-proof as completely as possible.

2. After the potatoes are harvested they should be marketed at once, unless the grower has storage facilities and is willing to take the trouble to treat the potatoes properly. The danger of storing tubers infected with the potato blight fungus, *Phytophthora infestans* must be guarded against. All potatoes showing symptoms of "Black-eye rot" must be rigorously discarded. In this connection it should be noted that Cobblers appear to be more susceptible to the disease than Garnets. It is desirable therefore that the Cobblers should be sold first.

3. It follows that potato tubers should be stored under the best possible conditions, well-housed and in sound barrels. Where sound barrels are not available, the tubers may be covered with dry earth or sand so that there is a layer at least four inches thick over the tubers. This method is practicable where there is only a small quantity of potatoes to be stored.

4. Once the tubers become infested the best way of ending the damage is to fumigate. Methyl Bromide has now superseded Carbon Bi-sulphide as a fumigant, but requires careful supervision as the gas is lethal.

5. When tubers are infested and facilities are lacking for storing in barrels, the progress of infestation can be checked by holding the potatoes in cold storage. It has been found that storage at 36° F. to 40° F., for 15 days is efficacious in destroying the potato tuber moth at all stages in its life history. However the benefits to be gained from cold storage in Bermuda are offset by the present cost of the local storage facilities which absorbs any increase in profit that might accrue in holding potatoes for a rise in prices.

THE JAPANESE BEETLE, *Popillia japonica* Newm.

During the course of the summer of 1938 there were large flights of the adult Japanese beetles in the vicinity of New York City harbour, which infested ships bound for Bermuda. Small quantities of dead beetles were found on the decks of these vessels when they docked at Hamilton, Bermuda, during the months of July and August. On account of the possible danger of live Japanese beetles being transported in a similar manner, it was decided to formulate quarantine measures in order, first, to ascertain in what manner of means and in what numbers live beetles could be transported to Bermuda, and secondly, to prevent their entry by interception and thus reduce the chances of the pests becoming established unobserved within these Islands.

Avenues of entry.

Two possible avenues of entry had to be safeguarded, first, that of introduction on commodities such as cut-flowers, fresh fruit, vegetables and other farm produce, or on passengers' clothing or baggage or on general cargo; and secondly, that of introduction on either the steamship or aircraft itself. In the first instance, inspection and certification of vegetables and plant material prior to export, and reinspection at the port of arrival, appeared to offer the best method for controlling movement of live beetles by this means. The examination of passengers' baggage, apart from the routine Customs inspection, was seen, however, to be impracticable on account of the unnecessary inconvenience which would be caused to passengers, most of whom are tourists.

The danger of importation by aircraft was seen to be in a sense much greater than in the case of the steamship, on account of the short duration of the voyage (about 5 hours). On the other hand it was one which could be more easily met. The contents of the aircraft could be readily inspected during flight and some form of disinsectisation carried out. The case of the steamship, however, was seen to be full of difficulties, on account of the larger number of possible hiding-places in which the beetles might secrete themselves. Then too, there was the problem of how to deal with large numbers of the insects, should such be discovered during the voyage. Large scale fumigating operations were quite clearly out of the question on board a tourist ship.

Quarantine Measures.

Bye-laws passed by the Board of Agriculture on 7th March, 1939, prohibited the importation of all plants, fresh unfrozen vegetables, and commercial shipments of cut-flowers, from the United States of America during the period 1st June to 30th September, unless they met the requirements of the Federal and State Quarantine No. 48 with respect to Japanese beetle, and were accompanied by certificates to this effect, issued by an authorised official of the United States Department of Agriculture. As a result, all consignments of cut-flowers and fresh vegetables from the United States were examined prior to shipment by Inspectors employed by the Bureau of Entomology and Plant Quarantine, and were accompanied by an Export Certificate issued by that Department. The shipments were reinspected by Inpectors of Produce attached to the Bermuda Department of Agriculture, on their arrival at Hamilton or St. George's.

The Japanese beetle was declared a notifiable pest on 16th May, 1939 in the Bermuda Government's Official Gazette.

Action taken by Masters of ships and aircraft.

Masters of steamships and aircraft were required to notify the Department of Agriculture if they found live beetles en route to Bermuda after 24 hours at sea and their crews were instructed to keep a sharp look-out for specimens. The decks of the steamships were thoroughly hosed down when at sea, and each day staterooms were carefully cleaned.

In the case of aircraft, precautions were taken by the Pan American Airways Company immediately prior to the embarkation of passengers, to spray their aircraft thoroughly with insecticide, after which it was left completely closed for ten minutes. Just before landing at Bermuda the aircraft was again sprayed. The insecticide used was a liquid made up of one and one-half parts of carbon tetrachloride, two and three-quarter parts of Sprayene oil, one part of Pyrocide Twenty (a commercial extractive containing two percent pyrethrins in kerosene). This mixture was atomized and disseminated by means of an ordinary commercial hand-type insecticide spray-gun. A quantity of ten cc. of mixture was used for each one thousand cubic feet of space.

Experiments kindly conducted by Dr. Hartzell, of the Boyce Thompson Institute for this Department throw some doubt on the efficacy of the above disinsectisation as a lethal control measure against the Japanese Beetle.

Establishment of Traps.

A total number of twenty-two Japanese beetle traps (Ellisco No. 4 type) were established at vantage points around the docks at Hamilton and St. George's. They were examined several times each week during the quarantine period.

Publicity Campaign.

It was realised from the outset, that the success of the control measures formulated against this new pest would largely depend on the degree of co-operation obtained between the individual and the Government. A publicity campaign, lasting over a month was carried out in order to educate the public with regard to the steps being taken to prevent

an introduction of the Japanese beetle from the United States during the summer months. An educational exhibit, staged for one week was well patronised, especially at Hamilton, and the keen interest of the public was gratifying. It is estimated that over 3,000 persons visited the exhibit (10% of total population). Every assistance was given by the local press, the Corporations of Hamilton and St. George's, agents of steamship and air services, as well as the merchants, in the carrying-out of the Department's precautionary measures.

Interception of live beetles.

The Department's publicity campaign in connection with the Japanese beetle brought fruitful results on 16th June, when a live female was picked up on Front Street, Hamilton, the main road running alongside the docks at a point near the Public Buildings, by a coloured man. The scouting traps which were set up at No. 7 Shed, No. 1 Shed, and at the Royal Bermuda Yacht Club on the 1st June, were checked immediately after the discovery but were all found to be empty. A further search in the vicinity failed to disclose the presence of any other specimens. A close watch was maintained in order to determine whether the live specimen caught represented a stray invasion from a ship or was representative of a locally established colony, but none other was found at that time. Since about 1,500 passengers from the United States had arrived in the previous four days, it appeared more than likely that the beetle was brought to Bermuda on clothing or baggage. On the other hand the date was early to find a specimen distributed so far from the United States. As may be seen from the table below, the next live beetle found in Bermuda was not intercepted until nearly a month later, in spite of an intensive search. There is no evidence up to the present date that colonies of Japanese beetles are established in Bermuda.

TABLE I.

Japanese Beetle Interceptions: 1939

Date	Locality	Beetles Intercepted		Remarks
		Alive	*Dead*	
June 16th	Front Street	1	...	Found on road near docks.
July 13th	"Queen of Bda."	1	...	In freight on dock
		1	...	In cargo hold
17th	Flatts	1	...	In baggage
24th	Hamilton	1	...	In cut flowers
26th	Darrell's Island	2	...	In aircraft
Aug. 7th	Hamilton	1	...	In china store
14th	Hamilton	...	1	In trap No. 1 Shed
	Total	8	1	

The last specimen recorded was found dead in one of the traps fixed at No. 1 Shed, on August 14th, after the "Monarch of Bermuda" had docked. This is the only record to date of a beetle being caught in a trap

in Bermuda. The position of the trap on the dock was only a few yards from the ship, from which the beetle must have flown at the time of docking. This record is interesting, since, on the many occasions on which ships have been examined, no live beetles have ever been found on the decks or superstructure. Several dozen dead beetles however were found on the life-boat decks towards the end of July. In spite of a vigilant search no beetles were found in any golf-bags, of which 496 were examined.

The records of interception listed above illustrate the difficulties to be met in attempting to block every loop-hole in a quarantine, no matter how strict the inspection service maintained, and also how important it has proved to enlist the public interest in the matter since members of the public have been responsible for intercepting most of the live beetles recorded. The most fruitful line of defence disclosed by these investigations, has been the hearty co-operation of members of the ships and flight crews, and of the general public, in maintaining a sharp watch for the beetles during the quarantine period. Without this assistance the Japanese beetle campaign would not have been the success it proved to be.

EXPERIMENTAL WORK ON FUNGICIDES AND INSECTICIDES.

Dusting experiments with "Calso" (Calcium arsenate) on potatoes against fireworms, *Xylomiges eridania* Cram. were satisfactory. Paris green poison bran proved effective against cutworms *Feltia subterranea* F., and millipedes, *Julus Moreleti* Lucas. The latter are sometimes harmful to potato tubers in the ground. Cutworms were active on cabbage and carrot seedlings and appeared to migrate from the grass bordering the experimental plots. Trials with a new poison, metaldehyde, against slugs and snails, were most successful, particularly against the "Round or American toothed snail", *Polygyra appressa* Say, and the "Spiral snail", *Rumina decollata* L. Metaldehyde can be obtained locally as "META", a solid fuel used for heating domestic appliances.

Spraying experiments with ready-made Bordeaux and wettable sulphur, carried out on vegetables and rose trees, gave satisfactory results. A liquid sticker and spreader, manufactured by Grasseli, also proved efficient under test. Pyrethrum sprays were found effective against aphis and leaf-hoppers, in lily and corn crops, but their relatively high cost may preclude their general use in Bermuda.

OFFICE WORK

The Office Work included correspondence on plant pathological matters and the writing of monthly reports. Articles were contributed to the Department's Agricultural Bulletin and to the local press. The design of the laboratory was re-arranged and the library and equipment maintained in good order.

Assistance was given to members of the Agricultural Commission from Cornell University in their survey of agricultural conditions in the Colony during the summer months. On the outbreak of hostilities between Great Britain and Germany, assistance was given to the Government's Nutrition campaign in addition to normal duties. A list of publications during the year will be found at the end of this report.

ADVISORY WORK

Advice was given to farmers on the control of diseases and pests of crops and also to gardeners in connection with flowering plants and ornamentals. A leaflet entitled "Hints on Controlling Plant Diseases and Pests"

was printed for distribution. Information on the control of domestic and warehouse pests was also given on several occasions. The total number of lectures delivered on plant pathological matters was seven and included addresses to Boards, Clubs and Parish meetings. In addition, courses in Nature Study and Forestry were given to Boy Scouts. Successful candidates carried out pruning work in Smith's Parish and were remunerated from funds provided by the Smith's Parish Arbor Society. An educational exhibit showing specimens of Japanese Beetle, its life cycle and methods of control, was staged for a week, and was on view in the main thoroughfares of Hamilton, St. George's and Somerset. The present advisory service could be made more effective if advantage were taken of the opportunity for using some of the excellent educational films issued by the Extension Service of the United States Department of Agriculture. Good facilities exist for carrying out this type of extension work in Bermuda.

With the object of stimulating the local production of honey, a small Apiary was established at the Agricultural Station, together with a model extracting house. Beekeeping in Bermuda is a profitable side-line, and it it estimated that an annual production of £10,000 worth of honey could readily be obtained.

Work was also started on an agricultural exhibit at the Government Aquarium Museum.

INSPECTION SERVICES

Lily Inspection. Inspection of lily fields was started on 2nd January and continued throughout the month. The second inspection was carried out during the period March 13th—30th. Owing to the dry weather experienced during January and February, the general appearance of the crop was backward. One important effect of the dry conditions was the increase of insect pests, particularly aphis (*Aphis gossypii* Glov.), the insect vector of the virus disease, rosette. As a result, disease was unusually severe and few fields were found free from this trouble. A third inspection was therefore made during April, before permits for export were granted. A noticeable feature this year was the record of late infections of the disease in mature plants. As a result, roguing had to be continued right up to the time of harvesting. The disease made an early re-appearance in the autumn in early plantings of lilies and it is evident that growers will have to pay extra attention to roguing and spraying in the coming year if they are to maintain their stock free from disease. White grubs, the larvae of the beetle, *Ligyrus tumulosus* Burm. were also responsible for a considerable amount of damage to lily bulbs. The pest was most numerous in land that had been left idle to grass and other weeds prior to planting. If these fields, previous to planting, had been cultivated early in the year, and had borne a crop of cowpeas, ploughed in as a green manure, the amount of damage would have been greatly reduced.

A total of 29 fields passed the final inspection, giving an area of 3,807 sq. rods or 23.8 acres, a decrease of nearly 8 acres in comparison with the area recorded for last year. At the same time, a further decrease in the number of growers has to be recorded, from 40 to 27, due to the smaller ones dropping out of the competition. During the last four years, the number of lily growers has been reduced by nearly 50% and the area of lilies grown has been halved in nine years.

Potato Inspection. As in previous years the incidence of Leaf Roll in Bliss Triumph potatoes grown from seed obtained from Long Island, was much higher than in that from Canadian sources. Counts made in November ranged from 3% to 30% in some cases. Counts of Leaf Roll in local-grown Triumph seed were very high indeed. At the present time, no attempt is made by the local grower of seed potatoes to select healthy seed. In most cases, it is the smallest tubers saved from the preceding crop, which are most likely those produced from virus infected stock, that are used for seed purposes. The Department has started a project to determine whether it is commercially feasible to produce the Colony's requirements of seed potatoes locally, if proper attention is paid to roguing and control of insect vectors. If the scheme is successful it should materially aid in the conservation of local currency.

Inspection of Plant Importations. The number of importations of plants, vegetables and cut-flowers examined, far exceeded those of previous years. This was largely due to the intensification of plant inspection services during the summer months on account of the Japanese beetle quarantine. The number of Inspectors of Produce employed during the quarantine period was six. During the period 1st June to 31st August inclusive, a total number of seventy steamships and twenty-eight aircraft visited the Colony from the United States and most of these were inspected. Several thousand packages of fresh vegetables, cut-flowers, and fruit were examined on arrival during this period. Special recognition is due to the Inspectors for the very thorough and conscientious manner in which they carried out their arduous task. The total number of consignments examined for the whole year was 1,323. In addition 496 golf bags were examined during the Japanese beetle quarantine period, making a grand total of 1,819 inspections. The increase in the number of occasions on which consignments of plants and other material have been inspected for the presence of diseases or pests during the past few years is shown by the following figures:

TABLE II.

Year	No. of Consignments Examined at Post Office or Docks
1935	300
1936	318
1937	298
1938	384
1939	1,819

As I have pointed out in previous Annual Reports, the task of inspecting plant importations is becoming increasingly arduous and occupies much valuable time which might otherwise be devoted to research. The total number of consignments passed at the time of inspection was 1,795, while 4 were passed after treatment with hydrocyanic acid gas. In 20 cases, plants or bulbs were confiscated and destroyed. These included lily and narcissus bulbs imported contrary to Bye-laws. Other violations of the Bye-laws were the importation of plants by aircraft without a permit on 4 occasions; the importation of plants in soil without a permit on 7 occasions; the importation of sweet potatoes and raw corn in the cob from the United States of America, both on one occasion. Noteworthy interceptions of serious diseases and pests, all from the United States, were as follows:—

TABLE III.

Disease or Pest	Material
Popillia japonica Newm. Japanese Beetle	Cut flowers, baggage, steamship and air-craft.
Macrodactylus subspinosus Fab. Rose Chafer	Cut flowers (Roses)
Sclerotinia americana (Wormald) Norton & Ezekiel Brown Rot	Fruit (Peaches)

The rose chafers were intercepted alive on roses in passenger's baggage on 24th June. This insect is a serious pest of Grape vines in the United States, particularly in regions with sandy soil. Brown rot, an important fungus disease in the United States, was commonly found on peaches imported during June and July. The disease attacks all portions of the tree and is responsible for blossom-blight, fruit-rot and brown-rot canker but has not so far been recorded in Bermuda.

Inspection of Plant Exportations. The number of consignments of bulbs and plants examined and certified as free from diseases and pests previous to their being exported was 97. The majority of these were Easter lily bulbs and English Royal Kidney potatoes.

Inspection of Vegetable Seed. Celery seed from France was satisfactory with regard to freedom from *Septoria* blight.

SPRAYING SERVICES

The two motor sprayers were maintained in working order throughout the year, one being kept at Southampton and the other at the Agricultural Station. They were employed together on 114 occasions, a decrease of 17 compared with the total for the previous year, chiefly for spraying potatoes and tomatoes. Supplies of oil emulsion were maintained and distributed when required.

DISEASES AND PESTS OBSERVED DURING THE YEAR.

Bananas. Banana fruit was exceptionally free from tip rot diseases as a result of the dry weather experienced this summer. One case of sooty mould and *Saisettia* scale infection was recorded in Southampton. The trouble had spread from a *Hibiscus* hedge.

Barley. Covered Smut, *Ustilago Hordei* (Pers.) Kell. & Swing., was recorded by T. A. Russell on plants grown for fodder in March.

Bean, Lima. Attack by red spider was recorded at the Agricultural Station in August.

Beets. Beets remained singularly free from fireworms, *Hymenia fascialis* Cram. during the autumn months.

Cassava. Considerable wastage due to an unidentified fungus was observed at the time of harvesting cassava tubers. The rot was observed to originate at the stem end, which in many cases had become damaged as a result of the highwinds. The matter is under investigation.

Cedars. Only one case of disease was reported, in July, which proved to be a local infection of rust disease. *Gymnosporangium bermudianum* (Farl.) Earle. The condition of the trees has much improved where pruning operations have been carried out, although the general appearance of the cedars at the present time is suffering from the effects of the October hurricane.

Cineraria. A powdery mildew (*Oidium* sp.) attacking this plant during April, proved amenable to control by dusting with sulphur.

Cockroach, German. A heavy infestation of German Cockroaches, *Blatella germanica* L. was found in a dirty bakery during May. Advice on control measures was given to the Department of Health.

Grape. Two cases of Grape Vine Phylloxera, *P. vitifoliae* Fitch were recorded during July on isolated vines in Pembroke and Devonshire.

Iris, Spanish. Rust disease, *Puccinia Iridis* (DC.) Wallr., continues to be recorded from Tucker's Town, but has not been observed in any other region in Bermuda.

Mediterranean Fruit Fly, *Ceratitis capitata* Wied. There is some evidence for believing that the incidence of this pest has decreased during the past few years. A close examination of 14 lbs. of fruit of the Surinam Cherry obtained from Warwick Parish in October, failed to reveal any specimens.

Parsnip. The fungus *Sclerotinia sclerotiorum* (Lib.) de Bary was recorded by T. A. Russell, attacking the petioles in March. The fungus was also found to be particularly destructive in ornamental beds of Star of the Veldt, *Dimorphotheca aurantiaca* DC., at the Agricultural Station.

Potato, Irish. An insect and rat-proof store house, built by S. Da Silva in Southampton was visited during the year. The owner claimed that he had suffered very little wastage due to the potato tuber moth, *Phthorimaea operculella*. His potatoes were lifted promptly and stored without delay. A loss of 10% due to *Fusarium* and bacterial rotting was found on grading 40 barrels of Long Island Bliss Triumph seed potatoes imported during August. No *Phytophthora* blight was recorded on the winter crop up till the end of the year.

Potato, Sweet. Specimens of the West Indian "Scarabee", *Euscepes postfasciatus* Fairm. were collected by Dr. Williamson in Southampton, from sweet potato tubers. This pest was last recorded by Ogilvie in 1925, as *E. batatae* Waterh., but is not in his list of Bermuda Insects. Ogilvie did not consider the insect to be a serious pest in Bermuda. Control measures depend on crop rotation, cleaning up old fields, planting clean seed and harvesting promptly. Production of sweet potatoes in Bermuda is largely a matter of small patches, from which the farmer digs out only enough for immediate personal consumption. Losses due to this pest may be expected to continue so long as this type of agriculture persists.

Mites or "red spider", were exceedingly abundant on sweet potatoes during the summer, several fields being seriously affected. The dry weather also undoubtedly contributed to the low yields obtained from this crop.

Nitrogen deficiency on light soils was indicated by yellowing of the foliage in some instances.

Queen of Shrubs. A mildew, *?Erysiphe lagerstroemiae* West, caused blighting of flowers and foliage of *Lagerstroemia indica* L., during the summer.

Spider Lily. Leaf Spot, due to the fungus *Cercospora Hemerocallidis* Tehon, was commonly observed.

Stock. A severe infection of the lower leaves of garden stock due to Downy Mildew, *Peronospora parasitica* (Pers.) de Bary was observed in April.

Sweet Pea. Failure to flower in sweet-peas in Paget was attributed to the planting of late flowering varieties which appear unsuitable for Bermuda.

Tomatoes. There was a considerable amount of Blossom End Rot affecting fruit as a result of the dry weather experienced in June. A severe case of root knot nematode *Heterodera marioni* (Cornu) Goodey, was observed on tomatoes grown in Warwick pond land, by C. D. C. Pires in August. Leaf Spot., *Septoria Lycopersici* Speg. was locally severe on unstaked plants in November.

Zinnia. Mildew, *Erysiphe Cichoracearum* DC., was observed to occur at a later date and with less intensity on irrigated plants compared with those without irrigation.

FUNGI AND INSECTS COLLECTED

Pressure of other duties gave little opportunity for the collection of fungi and insects. The followng are new or interesting records:—

Insects: Coleoptera:

Hydrophilidae; *Berosus infuscatus Lec.* Collected at Pembroke Marsh by J. Osborn. According to A. d'Orchymont, of the Musée Royal d'Histoire Naturelle de Belgique, Bruxelles, the water beetles *Berosus infuscatus* Lecoute 1855 and *B. bermudanus* are both the same species, and J. M. Jones in his "Naturalist in Bermuda" was correct in stating that most of the insects in Bermuda are imported from the nearest portion of the American continent, North Carolina, i.e. where *B. infuscatus* occurs at Southern Pines. (See C. S. Brimley, "The Insects of North Carolina", Department of Agriculture, 1938, p. 133).

Anobiidae: *Oligomerus obtusus* Lec. The larvae and adults of this beetle were found damaging wood-work in a house in Pembroke.

Scolytidae: *Coccotrypes dactyliperda* F., was found damaging compost trouser buttons imported from England. This beetle has previously been recorded by Ogilvie, associated with fallen fruits of the Bermuda Palmetto. The last two identifications were made by the Imperial Institute of Entomology.

Fungi:

The followng fungi, new to Bermuda, have kindly been identified by Miss E. M. Wakefield:—

No. 253 *Lenzites* sp., possibly a reduced form of *L. striata* (Sw.) Fr. but not at all typical. From a cedar telephone pole, St. George's. 20.4.39.

No. 254 *Daedalea Berkeleyi* Sacc., causing extensive rotting to an old fence rail, St. David's Island, 25.3.39.

No. 255 *Polyporus gilvus* (Schw.) Fr., on fallen logs of *Casuarina equisetifolia* L. and *Juniperus bermudiana* L., Paget, 21.4.39.

No. 256 *Odontia arguta* (Fr.) Quél., on fallen logs of *Casuarina equisetifolia* L. Paget, 21.4.39.

PUBLISHED WORK

1. "Annotated List of Diseases of Cultivated Plants in Bermuda", March, 1939. Published as a Departmental Bulletin.

2. With C. F. Blackler, C. G. G. Gilbert and H. Wilkinson, "Report on the State of Nutrition of School Children in Bermuda", November 1939. Published as a Government Report.

3. With M. Kennish and A. W. Wilson, "Thrift in War-time", November, 1939. Published by the Bermuda Women's Auxiliary Force: Nutrition Committee.

4. With F. J. Seaver, "Contributions to the Mycoflora of Bermuda–I". Read by the senior author before The Mycological Society of America 28th December 1939. In the Press.

RECORD OF MOVEMENTS

I was on duty in Bermuda throughout the year.

Respectfully submitted,

J. M. WATERSTON,
Plant Pathologist.

2nd January 1940.